Maximize Your Athletic Performance via MAXIMUS - The only RMT Device Designed For Use During Exercise.

Introduction: What is Respiratory Muscle Training Device - RMT?

Respiratory Muscle Training (RMT) is a method that uses resistance breathing exercises to enhance respiratory muscle function. Inspiratory muscle training (IMT) has been proven to improve respiratory muscle performance and may lessen shortness of breath (dyspnea) after exercise (Oliveira, 2021). RMT devices were initially designed for sick patients, asthmatics, CV Rehab, patients with poor lung muscle function, etc.

Only recently have we seen athletic focus devices catering to athletes.

MAXIMUS is the latest device, based on the science of RMT, designed for use during exercise, training, and practice.

Summary: In this RMT device white paper, we will share the multitude of research articles and describe our hypothesis for the development of an advanced RMT device that provides both inspiratory/expiratory resistance and has a profound impact on athletic performance improvement via our hypothesis that by using a device designed for use during exercise, elicits powerful effect on both lactate threshold and VO2 Max, thus, significantly improving strength and endurance. This is primarily due to the intensity of adding RMT designed for exercise, which has a variable impact depending on the intensity, frequency, and duration of the training while using the RMT device. In this paper, we discuss the impact on overall health and sports performance that MAXIMUS is having on both athletes and non-athletes, looking to improve cardio-respiratory fitness and sports-specific strength and endurance, as well as stress/anxiety relief, better sleep and overall sense of well-being. This research outlined below led to the design and development of Maximus, specifically for improving sports performance; first and foremost, however, the health benefits are equally impressive. Early research on the MAXIMUS RMT device shows significant improvements in strength and endurance; one must experience to believe the results. Both are from an overall health perspective, including stress relief, better sleep, etc. It reminds us of the early days of strength training with free weights when pundits said training with weights would make you less flexible and muscle-bound. Now we know strength training with weights, bands, etc., is critical to a well-balanced routine that includes regular stretching, strength training, nutrition, etc.

- Early research participant in prototype development and research with college athletes indicates a significant increase in strength and endurance in athletes and the average health enthusiast. Prototype users saw an average increase of 43% in strength and 24% in endurance. In a collegiate study of women's lacrosse, participants in the Maximus device group saw an average increase in strength of 44% vs.—the standard of care, no device used during exercise. The lacrosse player used the device for six weeks, doing the same exercises as the control group.

- This is the next frontier to taking athletic performance to the next level of human performance. Both lactate threshold and VO2 Max are improved, as well as many metrics involving lung efficiencies, maximum inspiratory pressures, maximum expiratory pressures, increased lung volume, intercostal muscle strength improvement, and more. Thus, early research backs all the reported benefits of RMT seen in athletes, mainly due to the accelerated impact of using the device during exercise, rapidly acting as a force multiplier on any exercise and maximally increasing all benefits.
- Devices that provide both inspiratory and expiratory breathing resistance during exercise are increasingly studied for their potential to enhance athletic performance, improve respiratory health, and support pulmonary rehabilitation. Here are some critical scientific studies that support the use of such devices:

Systematic Review and Meta-Analysis on Respiratory Muscle Training

Reference: Illi, S. K., Held, U., Frank, I., & Spengler, C. M. (2012). Effect of respiratory muscle training on exercise performance in healthy individuals: a systematic review and meta-analysis. *Sports Medicine*, 42(5), 707-724.

Methodology: This meta-analysis reviewed 21 studies involving healthy individuals to evaluate the impact of RMT on exercise performance. Both inspiratory and expiratory muscle training protocols were included.

Key Findings:

- RMT significantly increased maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP), indicating improved respiratory muscle strength.
- Endurance time was significantly increased across various exercise tests, including cycling and running.
- The perceived exertion during exercise was consistently reduced in participants who underwent RMT.

Specific Aspect: The study highlighted that RMT, involving both inspiratory and expiratory resistance, could enhance both the strength and endurance of respiratory muscles, leading to improved athletic performance and reduced fatigue during prolonged exercise.

Inspiratory and Expiratory Muscle Training in Cyclists

Reference: Romer, L. M., McConnell, A. K., & Jones, D. A. (2002). Effects of inspiratory muscle training on time-trial performance in trained cyclists. *Journal of Sports Sciences*, 20(7), 547-590.

Methodology: This study involved 20 trained cyclists divided into two groups: one group used a device providing inspiratory and expiratory resistance, while the control group used a sham device. The intervention lasted six weeks.

Key Findings:

- The intervention group showed a significant improvement in 20-kilometer time-trial performance compared to the control group.
- There was a marked increase in inspiratory muscle strength (measured by MIP) and expiratory muscle strength (measured by MEP).
- Participants reported a lower perception of breathlessness and exertion during the time trials.

Specific Aspect: This study provides evidence that combined inspiratory and expiratory muscle training can directly translate to better performance in time-trial events, a standard test of endurance and sustained effort in cycling.

High-Intensity Inspiratory Muscle Training in COPD

Reference: Hill, K., Jenkins, S. C., Philippe, D. L., McDonald, C. F., & Hillman, D. R. (2006). High-intensity inspiratory muscle training in COPD. *European Respiratory Journal*, 27(6), 1119-1128.

Methodology: The study involved 30 patients with moderate to severe COPD who underwent a 12-week high-intensity RMT program using a device that provided both inspiratory and expiratory resistance. The control group received the usual care without RMT.

Key Findings:

Participants in the RMT group showed a significant increase in both MIP and MEP, reflecting improved strength of the respiratory muscles.

There was a notable improvement in the 6-minute walk test, indicating better exercise capacity.

The RMT group's quality of life improved significantly, as measured by the Chronic Respiratory Disease Questionnaire (CRQ).

Specific Aspect: This study is particularly relevant for understanding how dual-resistance training can benefit patients with chronic respiratory conditions by improving respiratory muscle strength, overall functional capacity, and quality of life.

Long-Term Respiratory Muscle Training in COPD Patients

Reference: Beckerman, M., Magadle, R., Weiner, M., & Weiner, P. (2005). The effects of 1 year of specific inspiratory muscle training in patients with COPD. *Chest*, 128(5), 3177-3183.

Methodology: This long-term study involved 40 COPD patients who used a device that provided both inspiratory and expiratory resistance over one year. The study assessed changes in respiratory muscle strength, lung function, and exercise capacity.

Key Findings:

Significant improvements in both MIP and MEP were observed, indicating enhanced respiratory muscle function.

Lung function, as measured by forced expiratory volume in one second (FEV1), showed improvement in the RMT group compared to controls.

Exercise tolerance, as measured by incremental shuttle walk distance, increased significantly in the RMT group.

Dyspnea scores decreased, indicating less breathlessness during daily activities.

Specific Aspect: The study emphasizes the long-term benefits of dual-resistance respiratory muscle training, showing sustained improvements in respiratory function and exercise tolerance, which is crucial for patients with chronic respiratory diseases.

Respiratory Muscle Training in Rowers

Reference: Volianitis, S., McConnell, A. K., & Jones, D. A. (2001). Inspiratory muscle training improves rowing performance in well-trained rowers. *Medicine and Science in Sports and Exercise*, 33(5), 803-809.

Methodology: This study involved 16 well-trained rowers who underwent a 9-week RMT program with a device providing both inspiratory and expiratory resistance. The effects on rowing performance were measured.

Key Findings:

Rowers in the RMT group significantly improved rowing performance, as measured by the time taken to complete a 2000-meter rowing test.

Respiratory muscle strength (MIP and MEP) increased significantly in the RMT group compared to controls.

The RMT group reported a lower perception of effort and breathlessness during the rowing test.

Specific Aspect: This study demonstrates that even in highly trained athletes, such as competitive rowers, dual-resistance RMT can significantly enhance performance by improving respiratory muscle efficiency and reducing perceived exertion during high-intensity exercise.

Conclusion: These studies collectively support the effectiveness of devices that provide both inspiratory and expiratory resistance in enhancing respiratory muscle strength, improving exercise performance, and benefiting individuals with respiratory conditions. The research spans various populations, including healthy individuals, athletes, and patients with chronic respiratory diseases, highlighting this device's versatility and broad applicability.
How would you design a device to optimize RMT with both inspiratory and expiratory resistance for optimization during exercise?

The concept of CO2 buildup during exercise, mainly when using a Respiratory Muscle Training (RMT) device, relates to the idea of "hypercapnic training," where controlled exposure to higher levels of CO2 is used to induce specific physiological adaptations. However, it is essential to note that the research in this area is complex and nuanced. Some studies suggest potential benefits, often contingent on careful monitoring and controlled environments.

Fundamental Research and Concepts:
Hypercapnic Training and Ventilatory Efficiency

Reference: Dempsey, J. A., & Wagner, P. D. (1999). Exercise-induced arterial hypoxemia. *Journal of Applied Physiology*, 87(6), 1997-2006.

Summary: This study discusses the impact of exercise-induced arterial hypoxemia, a condition with insufficient oxygen in the blood during high-intensity exercise. The authors mention the role of controlled hypercapnia (increased CO2 levels) in potentially improving ventilatory efficiency by stimulating respiratory centers in the brain, leading to more effective breathing patterns during intense exercise.

Implication: The idea is that controlled CO2 buildup during RMT could enhance an athlete's ventilatory efficiency by training the body to handle higher CO2 levels more effectively, thereby improving endurance and reducing the sensation of breathlessness during exercise.

CO2 Tolerance Training in Athletes

Reference: Stickland, M. K., Lindinger, M. I., & Heigenhauser, G. J. F. (2004). Investigations of the role of hypercapnia in limiting exercise performance in humans. *Journal of Physiology*, 561(Pt 2), 669-677.

Summary: This study investigated the role of hypercapnia (elevated CO2 levels) during exercise and its impact on performance. The researchers found that moderate hypercapnia could enhance respiratory drive, potentially improving the ability to maintain high levels of physical exertion.

Implication: The findings suggest that athletes using an RMT device that induces mild CO2 buildup might experience enhanced respiratory drive, which could be beneficial in sustaining high-intensity exercise.

Training Adaptations and CO2 Retention

Reference: McConnell, A. K., & Romer, L. M. (2004). Respiratory muscle training in healthy humans: resolving the controversy. *International Journal of Sports Medicine*, 25(4), 284-293.

Summary: This review examines various aspects of respiratory muscle training, including the potential benefits of increased CO2 retention during training. It highlights that controlled CO2 exposure can lead to adaptations that improve the buffering capacity of the blood and increase tolerance to higher levels of CO2 during exercise.

Implication: The study suggests that controlled CO2 buildup during RMT could lead to adaptations that improve an athlete's ability to buffer and tolerate CO2, potentially enhancing performance during endurance sports.

CO2 Buildup and Respiratory Muscle Fatigue

Reference: Powers, S. K., & Howley, E. T. (2018). Exercise Physiology: Theory and Application to Fitness and Performance. *McGraw-Hill Education*.

Summary: This textbook discusses the physiological responses to CO2 buildup during exercise, including stimulating respiratory muscles and potentially reducing respiratory muscle fatigue. It suggests moderate CO2 retention could make respiratory muscles more efficient, potentially delaying fatigue during prolonged exercise.

Implication: For athletes, training under conditions that induce moderate CO2 buildup might enhance respiratory muscle efficiency and delay the onset of fatigue, thereby improving overall performance.

Key Considerations:

Controlled Exposure: The potential benefits of CO2 buildup are contingent on careful control and monitoring. Excessive CO2 can be harmful, leading to symptoms like dizziness, headaches, and even impaired cognitive function. Therefore, using RMT devices to induce CO2 buildup should be done under controlled conditions, possibly with the guidance of a coach or medical professional.

Individual Variation: Not all athletes respond the same way to CO2 buildup. Individual tolerance to CO2 can vary, meaning training protocols should be personalized to maximize benefits while minimizing risks.

Conclusion: The research indicates that controlled CO2 buildup during exercise with an RMT device might offer benefits such as enhanced ventilatory efficiency, improved respiratory muscle conditioning, and increased tolerance to CO2, potentially leading to better athletic performance. However, these benefits are closely tied to the controlled and monitored application of CO2 exposure, making it crucial to approach this type of training cautiously.

The Physiology of RMT Benefits

When the work of breathing increases, blood flow to the legs is reduced. If the breathing rate is decreased, cardiac output reduces. Thus, blood flow to the legs can increase. It is thought that the metaboreflex can explain these changes.

They are stimulated when metabolites build up, providing signals to the cardiovascular controllers. This, in turn, sets off a reflex increase in sympathetic outflow, constricting the blood vessels in the limbs and the airways.

As a result, the blood supply to the limbs alters, which raises blood pressure and lowers blood flow. Since training increases the effort that must be done before the reflex is triggered, it may be able to sustain blood flow to the limbs for a more extended period and improve performance (McConnell, 2013).

RMT Enhances Hypoxic Training of Athletes

There is proof that RMT improves sports performance and has many other positive impacts on healthy individuals. The research findings conclusively demonstrate that IMT results in statistically significant performance improvements (Oliveira, 2021)**.** A more recent evaluation investigated the application of RMT in hypoxic circumstances. Although hypoxic training has grown in popularity among athletes, it can have unfavorable effects, such as respiratory muscle exhaustion after an extended activity. It has been shown to enhance breathing patterns, increase respiration's effectiveness, lessen dyspnea's sensation, and enhance performance in hypoxic situations (Álvarez-Herms, 2019).

Hypercapnic training, which involves deliberately exposing the body to elevated levels of carbon dioxide (CO_2), is being explored by athletes to enhance performance, particularly in endurance sports. The idea is to simulate intense exercise conditions where CO_2 levels in the blood rise due to increased muscle activity. Here is how athletes are using this technique:

Improving Respiratory Efficiency

Mechanism: Hypercapnic training is thought to improve the efficiency of the respiratory system by increasing the tolerance to higher CO_2 levels. This can potentially enhance an athlete's ability to maintain performance under conditions where they would otherwise experience discomfort or a strong urge to breathe.

Training Method: Athletes might use specialized breathing devices or training masks that increase resistance or retain CO_2 to simulate hypercapnic conditions during their workouts.

Enhanced Tolerance to High Intensity

Mechanism: Training under hypercapnic conditions can help athletes adapt to the high levels of CO_2 produced during intense exercise. This adaptation may allow them to sustain higher intensities without experiencing as much respiratory distress for extended periods.

Training Method: Interval training with added CO_2 stress, such as breath-holding exercises or workouts at high altitudes where the air is thinner, and CO_2 levels in the body can rise more quickly.

Stimulating Erythropoiesis (Red et al.)

Mechanism: The body may respond to elevated CO_2 by increasing erythropoiesis, which boosts red blood cell production. More red blood cells can improve oxygen delivery to muscles, enhancing endurance.

Training Method: Consistent exposure to hypercapnic conditions through repeated training sessions or living at high altitudes stimulates this adaptation over time.

Increasing Mental Toughness

Mechanism: Hypercapnic training can also build mental resilience by forcing athletes to continue performing under discomfort. The sensation of high CO_2 levels often triggers a strong urge to breathe, and training to resist this impulse can strengthen mental toughness.

Training Method: Mental training techniques, such as mindfulness or visualization exercises, combined with hypercapnic conditions, are sometimes integrated into workouts.

Improving Lactate Clearance

Mechanism: Some athletes believe that hypercapnic training helps clear lactate from the muscles, which accumulates during anaerobic exercise and contributes to muscle fatigue.

Training Method: High-intensity interval training (HIIT) combined with controlled breathing techniques that elevate CO_2 levels, aiming to improve the body's efficiency in clearing lactate.

Considerations and Risks

While hypercapnic training shows potential benefits, it has risks. Excessive CO_2 levels can lead to respiratory acidosis, dizziness, or even fainting. Therefore, athletes must approach this training method cautiously, ideally under the supervision of a coach or medical professional experienced in respiratory physiology.

Athletes who use hypercapnic training often participate in a broader, periodized training program that carefully integrates this technique to avoid overtraining or adverse effects.

Hypercapnic training is a relatively niche area of sports science, but there is a growing interest in its potential benefits for athletic performance. Below is a more detailed explanation of the training methods, potential benefits, and references to studies exploring hypercapnia in athletic contexts.

Detailed Explanation of Hypercapnic Training

Mechanism of Action:
Respiratory Adaptation: The body's normal response to increased levels of carbon dioxide (CO_2) is to increase breathing rate to expel excess CO_2. Hypercapnic training aims to condition the respiratory system to tolerate higher CO_2 levels, potentially enhancing an athlete's ability to maintain performance under conditions of high metabolic demand.
Buffering Capacity: Exposure to high CO_2 levels can stimulate the body to enhance its buffering capacity, which is the ability to neutralize the acid produced during high-intensity exercise. This could lead to improved endurance and delayed onset of fatigue.
Training Methods:
Breathing Devices: Some athletes use devices that restrict airflow, increasing the CO_2 concentration in the air they inhale. These devices simulate hypercapnic conditions and can be used during various training sessions.
High-Intensity Interval Training (HIIT): By integrating breath-holding exercises or restricted breathing techniques into HIIT workouts, athletes can create a hypercapnic environment that trains the body to perform under increased CO_2 levels.
Altitude Training: Training at high altitudes naturally induces a degree of hypercapnia due to lower oxygen levels and increased CO_2 retention. This can be part of an athlete's overall strategy to improve performance.

Potential Benefits of Hypercapnic Training

Increased CO_2 Tolerance:
Improved CO_2 tolerance can allow athletes to sustain higher exertion levels without experiencing as much respiratory distress. This could be particularly beneficial in sports that require sustained high-intensity efforts, such as cycling, rowing, or running.
Enhanced Blood Oxygen Transport:
Some studies suggest that hypercapnia can stimulate erythropoiesis (red blood cell production), potentially improving oxygen transport in the blood. This adaptation is similar to the effects sought through altitude training.
Improved Lactate Clearance:
The ability to tolerate higher CO_2 levels might also help clear lactate from muscles, delaying the onset of muscle fatigue during intense exercise.
Mental Toughness:
Training under hypercapnic conditions can increase an athlete's ability to perform under discomfort, building mental resilience.

Study References

Here are some studies and references that explore the effects of hypercapnia or related concepts in sports science:

Stellingwerff, T., et al. (2011). "The Development of a Hypercapnic Training Model and the Analysis of its Impact on Running Performance."
This study explores the development of a training model involving controlled hypercapnic conditions and analyzes its impact on running performance, suggesting potential benefits in endurance.
Poon, C. S., & Greene, N. M. (1985). "Effects of Increased CO_2 on Ventilatory Efficiency during Exercise."
This research investigates the impact of elevated CO_2 levels on ventilatory efficiency during exercise, providing insight into how hypercapnic conditions might influence respiratory adaptations.
Mukai, N., et al. (2000). "Effects of Mild Hypercapnia on Cardiovascular and Metabolic Responses to Exercise".
This study examines how mild hypercapnia affects cardiovascular and metabolic responses during exercise, indicating potential benefits regarding metabolic efficiency.
Foster, G. E., & Sheel, A. W. (2005). "The Human Diving Response, Its Function, and Its Control during Breath-Hold Diving." Although focused on breath-hold diving, this study discusses the body's response to hypercapnia, providing valuable insights for athletes interested in breath-hold or restricted breathing exercises as part of their training.
Bussotti, M., & Somers, V. K. (2005). "The Respiratory Response to Exercise in Humans."

This review article offers a comprehensive overview of how the respiratory system responds to exercise, including the effects of hypercapnia. This can help us understand the physiological basis of hypercapnic training.

Conclusion

Hypercapnic training is still an emerging area in sports science. While some evidence supports its potential benefits, athletes must approach this training method with caution. The effects can vary depending on the individual, the intensity of the hypercapnic exposure, and the overall training regimen. Athletes considering integrating hypercapnic training into their routines should consult with sports scientists, coaches, or medical professionals.

Hypercapnic training, which involves exposure to elevated levels of carbon dioxide (CO_2), can have several potential effects on mitochondrial cells, particularly in athletic performance and endurance training. Mitochondria are critical for cell energy production, especially during exercise, as they generate ATP (adenosine triphosphate) through oxidative phosphorylation. Here is how hypercapnic training might impact mitochondria:

Increased Mitochondrial Biogenesis

Mechanism: Hypercapnic training may stimulate mitochondrial biogenesis, the process by which new mitochondria are formed in cells. This can respond to increased metabolic demand and the need for enhanced energy production during sustained or intense exercise.
Impact: More mitochondria in muscle cells can improve the efficiency of energy production, allowing athletes to perform better during endurance events. A greater number of mitochondria can help sustain aerobic metabolism, reducing the reliance on anaerobic pathways that produce lactate and lead to fatigue.

Enhanced Mitochondrial Efficiency

Mechanism: Exposure to higher levels of CO_2 during hypercapnic training might lead to adaptations in the mitochondria that improve their efficiency. This could involve an increase in the efficiency of oxidative phosphorylation, meaning that more ATP is produced per unit of oxygen consumed.
Impact: Enhanced mitochondrial efficiency can help athletes perform better during prolonged exercise, as it improves the muscles' ability to sustain energy production over time, delaying the onset of fatigue.

Improved Lactate Clearance and Utilization

Mechanism: Hypercapnic conditions can enhance the body's ability to utilize lactate as a fuel source. Mitochondria can oxidize lactate into pyruvate, which can enter the Krebs cycle for further ATP production. This process helps clear lactate from the muscles, reducing the accumulation contributing to muscle fatigue.
Impact: Hypercapnic training can enhance an athlete's endurance and recovery by improving lactate clearance, allowing them to sustain high-intensity efforts for longer periods.

Increased Antioxidant Defense

Mechanism: Elevated CO_2 levels can lead to an increase in the production of reactive oxygen species (ROS) within the mitochondria, which, in high concentrations, can damage cellular structures. However, moderate increases in ROS can stimulate the production of antioxidant enzymes, which protect mitochondria from oxidative stress.
Impact: A more muscular antioxidant defense system can help maintain mitochondrial integrity and function, particularly during intense exercise when oxidative stress is elevated. This can contribute to better overall cellular health, longevity, and improved athletic performance.

Adaptation to Hypoxic Conditions

Mechanism: Hypercapnic training often mimics the effects of hypoxia (low oxygen levels), a condition that can also occur naturally during high-altitude training. Under hypoxic conditions, mitochondria adapt by increasing their efficiency in oxygen utilization, a response that is also likely triggered by hypercapnia.
Impact: These adaptations help the body become more efficient in low-oxygen environments, which can benefit athletes who compete at high altitudes or in sports requiring sustained effort in conditions where oxygen delivery might be compromised.

Research and Evidence

While the direct effects of hypercapnic training on mitochondria are not extensively studied, related research on hypoxia, high-intensity interval training, and breath-hold training provide insights into how similar physiological stressors can influence mitochondrial function. The following references explore aspects of mitochondrial adaptation that are relevant to hypercapnic conditions:

Holloszy, J. O. (1967). "Biochemical Adaptations in Muscle: Effects of Exercise on Mitochondrial Oxygen Uptake and Respiratory Enzyme Activity in Skeletal Muscle."

This foundational study discusses how exercise induces mitochondrial biogenesis and adaptations in muscle cells, which hypercapnic conditions could similarly influence.

Levine, B. D., & Stray-Gundersen, J. (1997). "Living High-Training Low: Effect of Moderate-Altitude Acclimatization with Low-Altitude Training on Performance."

This research highlights the benefits of altitude training, which shares similarities with hypercapnic training regarding mitochondrial adaptation.

Gnaiger, E. (2009). "Capacity of Oxidative Phosphorylation in Human Skeletal Muscle: New Perspectives of Mitochondrial Physiology."

This article provides insights into how mitochondria adapt to various physiological demands, including those that hypercapnic conditions might impose.

Boushel, R., & Gnaiger, E. (2012). "Oxygen Uptake and Mitochondrial Function: Dynamics of O2 Supply and Demand".

This study examines the dynamics of oxygen uptake and mitochondrial function, offering a perspective on how mitochondria might adapt to the increased CO_2 levels during hypercapnic training.

Conclusion

Hypercapnic training could influence mitochondrial function by promoting mitochondrial biogenesis, improving oxidative phosphorylation efficiency, enhancing lactate clearance, boosting antioxidant defenses, and facilitating adaptation to low-oxygen conditions. While more research is needed specifically on the effects of hypercapnia on mitochondria, these adaptations are likely to contribute to improved athletic performance, particularly in endurance sports. Athletes interested in this type of training should consider it part of a comprehensive, periodized training plan and consult with experts in exercise physiology to ensure safe and effective implementation.

RMT Relieves Stress, Anxiety, and Depression Validated by Various Studies

You may be amazed that no new scientific breakthrough has found that Diaphragmatic breathing has also been studied in conjunction with meditation, old Eastern religions, and martial arts. It is an essential component of yoga and Tai Chi Chuan (TCC), and it helps with emotional balance, social adaption, and distinctive rhythmic motions and positions (Lehrer et al., 2010)

Breathing exercises, commonly called "deep breathing" or "diaphragmatic breathing," are effectively integrated body-mind training for managing stress and psychosomatic illnesses. Diaphragmatic breathing deepens inhalations and exhalations, contracts the diaphragm, and expands the abdomen. This reduces the frequency of breathing while increasing the number of blood gases in the body, lessening stress and anxiety in individuals.

Recently, Nuez-Flores et al. (2021) examined how a high-intensity home-based RMT program affects the quality of life, lung function, psychological state, and a healthy mind. They found that RMT interventions can reduce stress and enhance the quality of life.

In another psychological research, Brown (2005) found that anxiety, melancholy, and stress may all be reduced with breathing exercises, which are very effective non-pharmacological interventions. Additionally, Yu and Song (2010) showed similar advantages on anxiety in a 3-day intervention study where subjects who practiced breathing exercises three times each day reported much less stress.

Breathing exercises are often used in therapeutic settings to treat mental illnesses such as depression, anxiety, and stress, including post-traumatic stress disorder (PTSD) (Goldin & Gross, 2010).

A study by Ma et al. (2017) Showed How RMT Relieves Stress, Anxiety, and Depression,

In reaction to stress, the glucocorticoid steroid hormone cortisol is produced. The release of cortisol is linked to depression, anxiety, and other unpleasant feelings. The underlying basis may be the hypothalamic-pituitary-adrenal (HPA) axis, which controls metabolic reactions, immunity, and specific mental processes, including memories and emotional evaluation.

Mechanism because of its sensitivity to its activity. Salivary cortisol levels have been linked to anxiety and depression. In contrast, plasma cortisol levels reflect variations in the activation of the HPA axis with changes in CO2 inhalation (Clow et al., 2010; Ma et al. (2017).

To determine if RMT can significantly enhance cognitive function and decrease negative affect and stress, Ma et al. (2017) undertook an 8-week breathing training course.

Ma et al. (2017) found that in their study, the breathing intervention group (BIG) demonstrated considerably greater sustained attention following training than the control group. In the diaphragmatic breathing condition, there was a highly significant impact of group and time on cortisol levels, with the BIG having a considerably lower cortisol level after training and the control group (CG) having no significant change in cortisol levels.

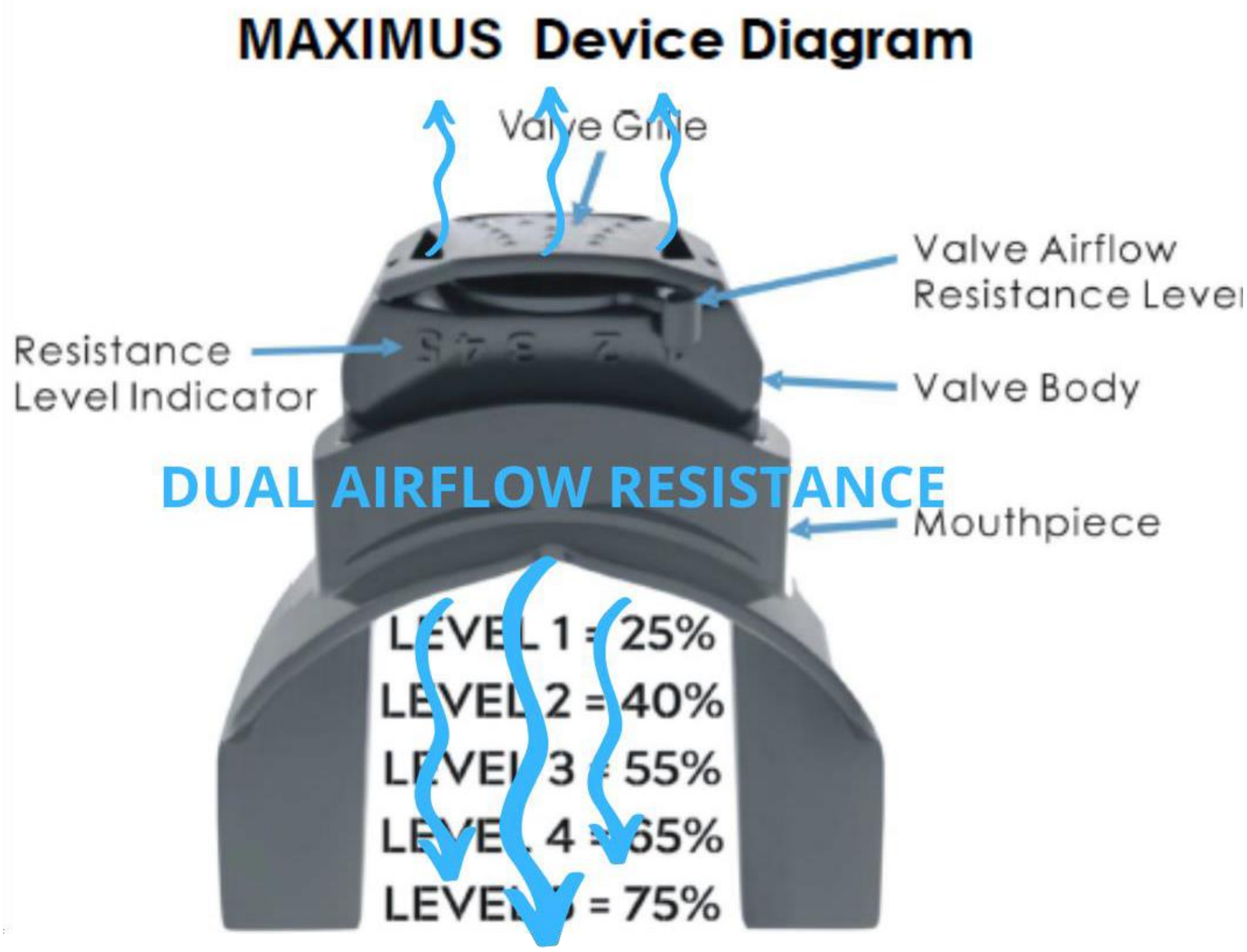
They concluded that RMT had been shown to promote sustained attention, emotion, and cortisol levels. From a health psychology standpoint, this study produced data proving the influence of RMT, a mind-body activity, on mental function, which has crucial implications for stress relief.

Inspired by advanced and innovative evidenced-based scientific studies, we have designed a new device MAXIMUS Fitness Accelerator. MAXIMUS Fitness Accelerator was designed and built by the abovementioned two historical research done by HajGhanbari et al. (2013) and Rożek-Piechura *et al.* (2020)

Early data confirms that we can aggressively titrate the progression of training intensity because the device is designed for use during exercise where the intensity of training and advancement of two-way airflow resistance affords all users maximal results for maximal performance.

Until now, there were no devices designed with two-way resistance breathing, both inspiratory and expiratory resistance, designed for use during exercise for maximum intensity, that maximizes both strengths via improving lactate threshold and improved endurance by way of Vo2 max via overall improved breathing efficiencies, increased lung volume, increased inspiratory and expiratory max flow pressures. An athlete would only consider performing quadriceps exercises if they balance leg strength with hamstring exercises, nor vice versa, or biceps, not triceps. We train for balance in our muscles for the best overall athletic performance. When looking at the RMT device, MAXIMUS is the first device
with Dual Resistance Technology, designed for use during all exercises, except swimming, for maximum gains in performance.

MAXIMUS Fitness Accelerator is Designed for MAXIMUM RESULTS when used during exercises for athletes and health enthusiasts looking to live a healthy Lifestyle.



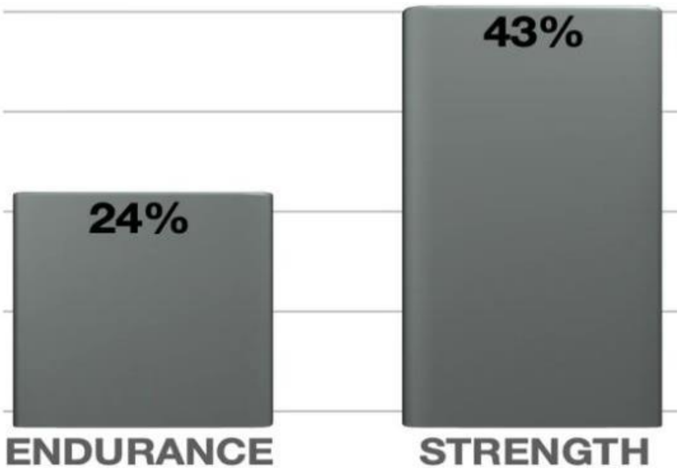
Prototype User Study Revealed MAXIMUM Performance Improvement

It is what we have seen with both prototype users, helping to develop the product and significantly increasing endurance and strength performance.

Prototype User Protocol Study: Early prototype users signed a confidentiality agreement and agreed to the following stipulations.
Users agreed to perform baseline testing to gain a baseline in strength and endurance performance. No device was used during the baseline testing.
At least one endurance exercise and two or three strength exercises were chosen. The most common strength exercises were pushups and pull-ups.
Users agreed not to alter their nutrition habits based on what they usually consume during the 8-week trial.
Users agreed to not add any new supplements to their routine during the 8-week trial.
After eight weeks of using the device, users again performed the same baseline test with no device.

Comparison from the original baseline to week-9 baseline numbers was calculated for the numbers as seen above for strength increase.
On average, MAXIMUS prototype users saw a 24% Increase in Endurance and 43% in strength after eight weeks.

*Prototype users were not high-level athletes, thus more likely for significant gains.
The only change made was adding a MAXIMUS device during their training routine.



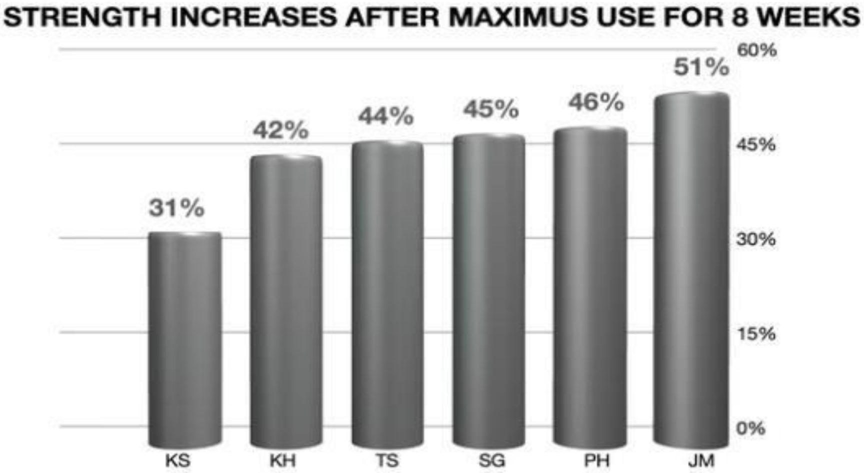
They increased Strength and endurance. *Results are variable and dependent on baseline fitness, frequency of device use, resistance levels employed, duration of training sessions, and intensity of exercise.

Increase VO2 Max Score

After 16 weeks of using MAXIMUS during exercise, my Endurance and VO2 Max score improved by 25%.

This is one prototype user's experience using MAXIMUS over 16 weeks with VO2 testing using Polar Technology.
Results are variable and dependent on baseline fitness, frequency of device use, resistance levels employed, duration of training sessions, and intensity.

Prototype Users Increased STRENGTH ranging from 31% to 51%.



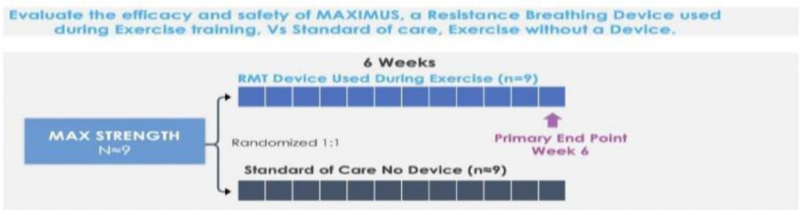
*Results are variable and dependent on baseline fitness, frequency of device use, resistance levels employed, duration, and intensity of training sessions.

STUDY #2: Evaluating the Performance of College Lacrosse Teams Using MAXIMUS Device Fitness Accelerator

Study Design and Inclusion Criteria: This is a single-center, randomized, active-control study. Participants were randomized to one of two age-matched, healthy women's college lacrosse teams—at least two in each group of f freshmen, sophomores, Juniors, and Seniors. The active control group performed the same exercise tests and routines. **<u>Exclusion criteria</u>:** Any athlete with a respiratory illness, chronic or otherwise, was excluded from participation. Any

A single-center randomized study of RMT was added to Exercise Vs. Standard of care exercise no device, same exercise routine. J Francis et al. (2022)

This randomized study of a woman's college lacrosse team showed a similar increase in strength to that of the prototype user study of 44% in the device group over an active control group consisting of training with no device and the same exercises and cadence as the device group. This is consistent with prototype users looking at the intensity of RMT training and the associated increases in lactate threshold. We hypothesize that, regardless of exercise, the lactate threshold increases dramatically with use over time because the resistance and intensity are greatest using a device during exercise.



STRENGTH RESULTS

MAXIMUS Group					MAXIMUS Group			
Name	Squat/Time	Squat/Time	Avg. % Difference	22%	Push up/Time	Push up/Time	Avg. % Difference	71%
Robbie	51/1:29	64/1:35	13	25%	1/0:08	2/:07	1	100%
Kaylen	125/3:45	93/2:30			6/0:23	12/:28	6	100%
Becka	50/1:23	INJ			10/0:28	INJ		
Sophia H.	15/:39	INJ			8/0:21	INJ		
Kierra	60/2:24	80/1:52	20	33%	20/0:35	30/:43	10	50%
Grace	46/1:34	45/:59			6/0:15	7/:33	1	14%
Courtney	78/2:47	84/2:38	6	8%	6/0:17	10/:40	4	66%
Sarah	80/2:50	90/2:37	10	20%	4/0:26	8/:40	4	100%
Molly	111/3:32				1/0:07	1/:08		0%
			Total %	86%			Total %	430%
Control Group					Control Group			
Name	Squat/Time	Squat/Time	Avg. % Difference	16%	Push up/Time	Push up/Time	Avg. % Difference	47%
Gemma	38/1:02	41/:55	3	8%	14/0:43	17/:42	3	21%
Regan	34/1:04	INJ			0/0:02	INJ		
Solei	60/1:43	47/1:26			5/0:12	8/:31	3	60%
Gianna	38/:58	INJ			0/0:02	INJ		
Sloan	85/2:21	80/1:41			17/0:37	30/:38	13	76%
Christen	48/1:26	55/1:10	7	14.50%	4/0:20	7/0:30	3	75%
Sophia J.	70/2:06	82/1:48	12	17%	12/0:35	5/0:20		0%
Terra	93/3:12	53/1:26			20/0:33	30/0:53	10	50%
Claudia	145/3:32	180/3:53	35	24%	19/0:30	20/0:30	1	5%
Shannon	?	22/:32				0/0:03		0%
			Total %	64%			Total %	287%

SQUATS	38%	improvement over standard exercise control group/no device
PUSHUPS	51%	improvement over standard exercise control group/no device

**Overall Strength gains averaged 44.5% increase in strength for both squats and push ups Vs. the control group. Calculations performed on those athletes that had a positive gain, improvement over previous baseline in both groups

Designing a device to optimize respiratory muscle training (RMT) with both inspiratory and expiratory resistance, especially for use during exercise, involves several critical considerations. The device should be user-friendly, adjustable, durable, and capable of providing measurable benefits to respiratory muscle strength and endurance. Here is a step-by-step approach to the design:

Adjustable Resistance Levels: The device should offer adjustable resistance for both inspiratory and expiratory phases. This allows users to start at a comfortable level and progressively increase resistance as their respiratory muscles strengthen.

Comfort and Fit: The mouthpiece should be ergonomically designed for comfort, ensuring a snug fit that prevents air leaks without causing discomfort. It should be made of a hypoallergenic, soft material.

Portability: The device should be lightweight and portable so users can easily carry it to the gym or outdoors. It should also be durable and capable of withstanding drops, sweat, and outdoor conditions.

Variable Dual Resistance Mechanism: Inspiratory Resistance: Incorporate a one-way valve system that restricts airflow during inhalation. The resistance can be controlled via adjustable tension springs or diaphragm systems, where the user can increase or decrease the tension. **Expiratory Resistance:** Similarly, a one-way valve should restrict airflow during exhalation. The resistance here should also be adjustable and independent of the inspiratory resistance, allowing for fine-tuning based on specific training needs.

Breathability and Airflow Control: Ensure the device allows adequate airflow to avoid excessive buildup of CO2 and ensure user safety during prolonged exercise. Include safety features to prevent the device from completely occluding airflow if resistance settings are too high.

Ease of Cleaning: To maintain hygiene, especially after intense exercise sessions, the device should be easy to disassemble and clean, with removable and washable parts.

Current RMT Devices Available In The Market For Medical and Sports Purposes
MAXIMUS is the only device with DUAL RESISTANCE Designed to be used during EXERCISE

Device	Manufacturer/distributer	Inspiratory	Expiratory	Combination
Breather	PNMedical (Orlando, FL, USA)	Yes	Yes	Resistive
Threshold PEP	Philips ResporonKs (Murrysville. PA. USA)	Yes	Yes	Resistive and Threshold
Eolos	Aleas Europe (Miami. FL. USA)	Yes	Yes	Resistive
Threshold IMT	Philips Respironics (Murrysville, PA, USA)	Yes		Threshold
Pflex	Philips Respironics (Murrysville, PA, USA)	Yes		Resistive
POWERbreathe	POWERbreathe (Southam, UK)	Yes		Threshold
Trainer	Project Electronics Ltd (Erith, UK)	Yes		Resistive
Respifit S	Biegler GmbH (Mauerbach, Australia)	Yes		Resistive
Ultrabreathe	Tangent Healthcare Ltd. (Basingstoke, UK)	Yes		Resistive
Protex IMT	Smiths Medical (St Paul, MN, USA)	Yes		Resistive
EMST-150	Aspire Products (Atlanta, GA, USA)		Yes	Threshold
MAXIMUS	**Neo-Ventures LLC (Overland Park, KS)**	**Yes**	**Yes**	**Resistive**

MAXIMAL PERFORMANCE GAINS.
MAXIMUS is the first and only Resistance Breathing Trainer Device designed with PATENTED DART Technology—Dual Airflow Resistance Technology. This technology allows users to dial up airflow resistance equally, inhaling and exhaling, to increase cardio-respiratory fitness rapidly and maximally. This allows users to do more with less wear and tear on joints and muscles, acting as a FORCE Multiplier, regardless of your workout.

Achieve Your Health and Wellness Goals with MAXIMUS

Many potential benefits are elicited from this two-way resistance breathing device, including prototype user-reported benefits, such as lower blood pressure, better sleep, stress management, reduced snoring, and an improved sense of well-being.

Prototype Users Reported Benefits

Maximize Energy: The Maximus device is designed based on the most advanced research. It can reduce the respiratory rate by increasing lung volume, thus preserving energy and maximizing endurance and performance.

Increasing Focus: MAXIMUS helps in deep diaphragmatic breathing, which enhances your focus on deep breathing techniques.

During EXERCISE Use Benefits: MAXIMUS is used during exercise for Maximal Gains in strength, speed, and endurance.

Lower Resting Heart Rate: Using MAXIMUS during training or workouts helps the lungs maximize volume, reducing respiratory rate and ultimately lowering heart rate.